

## Original Research Article

## Comparision of efficacy of buprenorphine and dexmedetomidine as adjuvants to ropivacaine in ultrasound guided supraclavicular block in upper limb surgeries

R.V.S.S. Sahithi<sup>1</sup>, R. Rajeshwar Reddy<sup>2\*</sup><sup>1</sup>Postgraduate, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India<sup>2</sup>Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

Received: 11-11-2021 / Revised: 03-12-2021 / Accepted: 09-01-2022

**Abstract**

**Background:** Upper limb surgeries are commonly done under brachial plexus block. There are various approaches for brachial plexus block. Among them, supraclavicular approach is the most effective and commonly used method. It is performed at the division level with little or no sparing of dermatomes. A number of adjuvants have been used to enhance the effect of local anaesthetics in peripheral nerve block. This study was done to evaluate the efficacy of dexmedetomidine of 50 $\mu$ g over Buprenorphine of 300 $\mu$ g as an adjuvant to 0.5 % Ropivacaine in supraclavicular brachial plexus block. **Objectives:** To compare the efficacies of buprenorphine and dexmedetomidine as adjuvants to 0.5% ropivacaine used in USG guided supraclavicular brachial plexus block for elective upper limb surgeries. **Material and methods:** A prospective randomized comparative study. Institutional Ethical Committee approval was obtained to perform the study. Study was conducted on 50 Patients of ASA I, II of ages between 18-60 yrs who are undergoing elective upper limb surgeries performed under supraclavicular brachial plexus block. These patients are assigned into 2 groups of 25 each. **Results:** The results show that Dexmedetomidine as an adjuvant to Ropivacaine in supraclavicular brachial plexus block helps in prolonging the duration of motor blockade and duration of analgesia when compared to Buprenorphine without causing any post-operative side effects.

**Keywords:** Analgesia, Ropivacaine, Dexmedetomidine, Buprenorphine

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

**Introduction**

Pain is defined as an unpleasant sensory stimulus or an emotional experience associated with tissue damage. It can be associated with significant physiological and psychological effects during and after surgery. Over the years, peripheral nerve blockade has been an important part of anaesthesia. It involves the placement of a local anaesthetic agent around the nerve orplexus to render specific dermatomes insensitive to noxious surgical stimuli. Brachial plexus block is the most common method used for the upper extremity surgeries. Supraclavicular approach is currently the most effective method.

**Material and methods**

The present study was conducted in Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh from September 2020 to August 2021. 50 patients belonging to ASA physical status I,II of age between 18-60 years undergoing upper limb surgeries were included in this study after obtaining Ethical Committee approval and written informed consent from the patients. It was a prospective, randomized, double blinded study. All the patients underwent thorough preanesthetic evaluation with detailed history taking. General physical examination and systemic examination was done to all the patients. Airway assessment was done. All routine laboratory investigations were conducted. The anaesthetic procedure to be carried out was explained to the patients. They were educated regarding the visual analogue scale (VAS).

\*Correspondence

**Dr. R. Rajeshwar Reddy**

Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

E-mail: [sahithi.rvss@gmail.com](mailto:sahithi.rvss@gmail.com)

**Inclusion criteria**

1. ASA physical status I, II undergoing elective upper limb surgeries
2. Patients of age between 18-60 years

**Exclusion criteria**

1. Patient refusal
2. Allergy to Local anaesthetics and opioids
3. Local infection at the site of block
4. Pregnant women
5. Severe cardiopulmonary disease
6. Patients with Neurological deficit in operating arm
7. Bleeding disorders or patients on anticoagulants
8. ASA physical status III,IV
9. Conversion of peripheral nerve block to general anaesthesia

Patients were randomly assigned to two groups of 25 each.

Group A received block with 25 ml of 0.5% Ropivacaine + 50 mcg Dexmedetomidine. Group B received block with 25 ml of 0.5 % Ropivacaine + 0.3 mg of Buprenorphine.

**Materials**

1. Sterile tray, sterile swab, sterile towel, sponge holding forceps.
2. Drugs for the block: 0.5% Ropivacaine, Inj. Buprenorphine 300 mcg, Inj. Dexmedetomidine 30 mcg
3. Sterile needle for insertion.
4. High frequency ultrasound probe with sterile cover.
5. Equipment and drugs for resuscitation and conversion to general anaesthesia in case of block failure.

**Pre-operative preparation**

All the patients were premedicated with drug Inj. Ranitidine 50 mg and Inj.

Ondansetron 8 mg prior to the surgery. On arrival of patients to the operating room, basic monitors like pulse oximeter, NIBP and ECG

were connected. Baseline vital data of the patient were recorded. An 18G iv cannula was secured on the contralateral forearm and IV fluid infusion started. All emergency drugs and intubation kits were kept ready essential for emergency resuscitation of patient.

#### Supraclavicular block procedure

Patients were asked to lie down in supine position with their head turned to the opposite side, with their ipsilateral arm adducted. After sterile preparation of the block site, a sterile covered high frequency ultrasound transducer was placed in the sagittal plane in the supraclavicular fossa, proximal to the clavicle. Brachial plexus seen as a collection of three hypoechoic circles with hyperechoic outer

rings or a cluster of grapes located superolateral to the subclavian artery between the muscles - anterior scalene and middle scalene. Color Doppler can be used prior to needle insertion to prevent the passage of the needle into the vascular structures. A sterile block needle of 25G or 27G was used to perform the procedure. Nerve stimulation with 0.5mA current, for 0.1msec, is often associated with a motor response of the arm, forearm, or hand. Insertion of the needle into the sheath is associated with a palpable "pop." The predicted drug volume of 26 ml was administered around the visualized rings of brachial plexus after negative aspiration to avoid injection into vascular structures.

#### Results

**Table 1: Onset of sensory block**

Parameter observed	Ropivacaine + Dexmedetomidine	Ropivacaine + Buprenorphine	Mann Whitney u test t test
Onset of sensory block(minutes) [Median (IQR)]	7 (5, 8.50)	7 (6, 10)	0.452

The median onset time for sensory block is 7 (6,10) [minutes] in group A and 7 (5, 8.50) [minutes] in group B with P value of 0.452. There was no significant difference among two groups in the time for onset of sensory block.

**Table 2: Onset of motor block**

Parameter observed	Ropivacaine + dexmedetomidine	Ropivacaine + buprenorphine	Mann Whitney u test t test
Onset of motor block(minutes) [Median (IQR)]	10 (10,15)	11 (9, 15)	0.556

The Median onset time of motor block is 11[ 9,15] (min) in group A and 10 [ 10,15] (min) in group B with P value of 0.556 . There was no significant difference among two groups in the time for onset of motor block (P > 0.05).

**Table 3: Duration of sensory block**

Parameter observed	Ropivacaine + dexmedetomidine	Ropivacaine + buprenorphine	Unpaired t test
Duration of sensory block (Mean $\pm$ SD)	752.72 $\pm$ 124.32	681.52 $\pm$ 132.06	0.055

The mean duration of sensory block is  $681.52 \pm 132.06$  (minutes) in group A and  $752.72 \pm 124.32$  (minutes) in group B with P value of 0.055. There was no significant difference among two groups in the duration of sensory block (P > 0.05).

**Table 4: Duration of motor block:**

Parameter observed	Ropivacaine + dexmedetomidine	Ropivacaine + buprenorphine	Unpaired t test
Duration of motor block (Mean $\pm$ SD)	705 $\pm$ 120.26	630.52 $\pm$ 131.35	0.042

The mean duration of motor block is  $630.52 \pm 131.35$  (minutes) in group A and  $705.00 \pm 120.26$  (minutes) in group B with P value of 0.042. There is a significant difference among two groups in the duration of motor block (P < 0.05).

**Table 5: Duration of analgesia**

Parameter observed	Ropivacaine + dexmedetomidine	Ropivacaine + buprenorphine	Unpaired t test
Duration of analgesia (Mean $\pm$ SD)	776.48 $\pm$ 130.83	703.12 $\pm$ 124.74	0.048

The mean time for the duration of analgesia is  $703.12 \pm 124.74$  (min) in group A and  $776.48 \pm 130.83$  (min) in group B with P value of 0.048. There is a significant difference among two groups in the mean time of the duration of analgesia (P < 0.05).

#### Statistical analysis

Statistical analysis was done using unpaired t-test for finding the statistical difference between the means of quantitative data and two sample t-test for proportion. P value was calculated. P >0.05 was considered as not significant.

#### Discussion

Peripheral nerve blocks are used for upper limb surgeries as an alternative to general anaesthesia. It provides ideal conditions with muscle relaxation, stable intra-operative hemodynamics, adequate post op analgesia, less expensive, early recovery, and reduced side effects. USG guided technique provides imaging guidance during procedure improving the success rate, reducing the dose of local anaesthetic and with less complications. Hence, we chose supraclavicular brachial plexus block using ultrasound guided technique for this study. The advantages can be short lived and limited due to the relatively brief duration of the local anaesthetic

agents, resulting in block resolution followed by the period of post-operative pain. To overcome this, various adjuvants have been used with the local anaesthetic drugs to prolong the duration of intraoperative anaesthesia and postop analgesia. Opioids and alpha-2 adrenergic agonists are proved to be causing the desired effects.

Ropivacaine is a local anaesthetic drug belonging to amino amide group and is long acting similar to Bupivacaine. It is a pure S(-) enantiomer with significant reduction in CNS and cardiac toxicity. It has been found out that ropivacaine has similar efficacy as bupivacaine in peripheral nerve blocks with the least side effects.

Buprenorphine is a lipophilic opioid. It has high affinity for  $\mu$  receptors with longer duration of action and is cost effective. It also has lesser incidence of side effects such as respiratory depression and sedation. Various studies have shown that Buprenorphine is significantly effective as an adjuvant to local anaesthetic in supraclavicular block. Dexmedetomidine is a highly selective alpha-2 adrenergic receptor agonist, which has 8 times more affinity to alpha-

2 receptors. The present study was conducted to study the effects of Buprenorphine & Dexmedetomidine as an adjuvant to 0.5% Ropivacaine for USG guided brachial plexus block. A constant dose of Buprenorphine 300 mcg and Dexmedetomidine 50 mcg as adjuvants to Ropivacaine were used to conduct this study. The patients were divided into two groups and both groups received an equal volume of drug (0.5% Ropivacaine 25 ml + 1ml adjuvant, total of 26 ml). There was no significant difference observed between the two groups in the time of onset of sensory and motor block. There was no significant difference in the mean duration of sensory block among the two groups. We found in our study that duration of motor block is higher in the group receiving Ropivacaine plus Dexmedetomidine than the Buprenorphine group. Also, duration of analgesia is significantly higher in Dexmedetomidine group of patients. Side effects like Post operative vomiting are seen in Buprenorphine group and absent in Dexmedetomidine group.

### Conclusion

In the current study we conclude that, there is a significant increase in analgesia and duration of motor block with Dexmedetomidine compared to Buprenorphine. Lack of side effects such as post op vomiting makes dexmedetomidine an effective choice of adjuvant in supraclavicular brachial plexus blocks. The addition of Dexmedetomidine (30 microgram) to Ropivacaine in supraclavicular brachial plexus block shows prolongation of the duration of motor blockade and duration of analgesia when compared to Buprenorphine (300 microgram) without any post-operative side effects.

### References

- Dang PC. A novel of supraclavicular approach to brachial plexus block. *Anesth Analg* 1997;85(1):111-6.
- Berry M, Lawrence H, Susan BM. Standing nervous system. 38th ed. Chapter 8. In: *Gray's Anatomy*; 1995. pp. 902-1397.
- Kamibayashi T, Maze M – Clinical uses of alpha-2 adrenergic agonists *Anaesthesiology* 2000;93:1345-1349.
- Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. *Saudi J Anaesth*. 2015 Apr 1;9(2):148.
- Fritsch G, Danner T, Allerberger K, Tsodikov A, Felder TK, Kapeller M, et al. Dexmedetomidine added to ropivacaine extends the duration of interscalene brachial plexus blocks for elective shoulder surgery when compared with ropivacaine alone: a single-center, prospective, triple-blind, randomized controlled trial. *Reg Anesth Pain Med*. 2014 Feb;39(1):37-47.
- Rashmi HD, Komala HK. Effect of Dexmedetomidine as an Adjuvant to 0.75% Ropivacaine in Interscalene Brachial Plexus Block Using Nerve Stimulator: A Prospective, Randomized Double-blind Study. *Anesth Essays Res*. 2017 Mar;11(1):134-9.
- Bangera A, Manasa M, Krishna P. Comparison of effects of ropivacaine with and without dexmedetomidine in axillary brachial plexus block: A prospective randomized double-blinded clinical trial. *Saudi J Anaesth*. 2016;10(1):38-44.
- Koraki E, Stachtari C, Kapsokalyvas I, Stergiouda Z, Katsanevaki A, Trikoupi A. Dexmedetomidine as an adjuvant to 0.5% ropivacaine in ultrasound-guided axillary brachial plexus block. *J Clin Pharm Ther*. 2018 Jun;43(3):348-52.
- Agarwal S, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. *Journal of anaesthesiology, clinical pharmacology*. 2014 Jan;30(1):36.
- Das A, Majumdar S, Halder S, Chattopadhyay S, Pal S, Kundu R, Mandal SK, Chattopadhyay S. Effect of dexmedetomidine as adjuvant in ropivacaine-induced supraclavicular brachial plexus block: A prospective, double-blinded and randomized controlled study. *Saudi journal of anaesthesia*. 2014 Nov;8(Suppl 1):S72.
- Lomate PA, Mane MV. Efficacy of multimodal analgesia with perineural buprenorphine or dexmedetomidine for surgeries performed under ultrasound-guided infraclavicular brachial plexus block. *Journal of Anaesthesiology, Clinical Pharmacology*. 2020 Jan;36(1):66.
- Sreelakshmi V, Niyaz PV, Nagaraju T, Aluri A. To Compare the Effects of Adding Buprenorphine Vs Dexmedetomidine in Patients Undergoing Forearm Surgeries Under Supraclavicular Brachial Plexus Block. *International Journal of Health Sciences*. (I):8488-98.
- Sivakumar S, Rajarajeswaran K. Use of dexmedetomidine or buprenorphine along with bupivacaine for ultrasound guided brachial plexus block: A comparative randomized prospective study. *Indian Journal of Clinical Anaesthesia*. 2016;3(4):604-6.
- Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine ( $\alpha_2$  agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block: A randomised double-blind prospective study. *Indian journal of anaesthesia*. 2012 May;56(3):243.
- Biswas S, Das RK, Mukherjee G, Ghose T. Dexmedetomidine an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double blind prospective study. *Ethiopian Journal of health sciences*. 2014 Jul 31;24(3):203-8.
- Bharti N, Sardana DK, Bala I. The analgesic efficacy of dexmedetomidine as an adjunct to local anesthetics in supraclavicular brachial plexus block: a randomized controlled trial. *Anesthesia & Analgesia*. 2015 Dec 1;121(6):1655-60.
- Chinnappa J, Shivanna S, Pujari VS, Anandaswamy TC. Efficacy of dexmedetomidine with ropivacaine in supraclavicular brachial plexus block for upper limb surgeries. *Journal of Anaesthesiology, Clinical Pharmacology*. 2017 Jan;33(1):81.
- Kaur H, Singh G, Rani S, Gupta KK, Kumar M, Rajpal AS, Aggarwal S. Effect of dexmedetomidine as an adjuvant to levobupivacaine in supraclavicular brachial plexus block: a randomized double-blind prospective study. *Journal of anaesthesiology, clinical pharmacology*. 2015 Jul;31(3):333.
- Mathew S, Prasad S, Krishna R, Kumar A, Shiyad M. Ultrasound guided supraclavicular brachial plexus block using plain ropivacaine and ropivacaine with additives. *Sri Lankan J Anaesthesiol*. 2018 Jan 1;26(1):15-21.
- Shashikala TK, Madhyastha K. A prospective randomized double blinded study to evaluate the efficacy of dexmedetomidine 50  $\mu$ g intravenously and perineurally as an adjunct to 0.5% ropivacaine for supraclavicular brachial plexus block. *Anesthesia, Pain & Intensive Care*. 2017:413-9.
- Fultambkar G, Chavla P, Budi V, Gurram R, Kukreja V, Nair A. A prospective randomized comparative study of dexmedetomidine versus clonidine as an adjunct to 0.75% ropivacaine in ultrasound-guided supraclavicular brachial plexus block. *Research and Opinion in Anesthesia and Intensive Care*. 2022 Jan 1;9(1):29.
- Charlu SJ, Bhaskar BV. Comparative study between 0.25% bupivacaine and 0.25% bupivacaine with 50 [micro]g dexmedetomidine as an adjuvant for supraclavicular brachial plexus block: prospective clinical study. *Journal of Evolution of Medical and Dental Sciences*. 2016 Apr 25;5(33):1839-44.
- Khaleeq S, Azam M, Siddiq S, Shahid A, Butt Z, Asad N. Comparison of Dexmedetomidine and Dexamethasone as Adjuvant to Bupivacaine in Supraclavicular Brachial Plexus Block. *Annals of Punjab Medical College*. 2020 ;14(2):122-5.
- Lalwani J, Bhuaarya RN, Ali N, Shah PJ. Dexmedetomidine with 0.375% bupivacaine for prolongation of postoperative analgesia in supraclavicular brachial plexus block. *Indian Journal of Pain*. 2019 Jan 1;33(1):31.
- Manohar P, Prakash M. Comparison of the effects of fentanyl and dexmedetomidine in supraclavicular brachial plexus block achieved with 0.5% bupivacaine in KarpagaVinayaga Medical College and Hospital, Maduranthagam. *JMSCR*. 2015;3(8):7131-8.

**Conflict of Interest: Nil** **Source of support: Nil**